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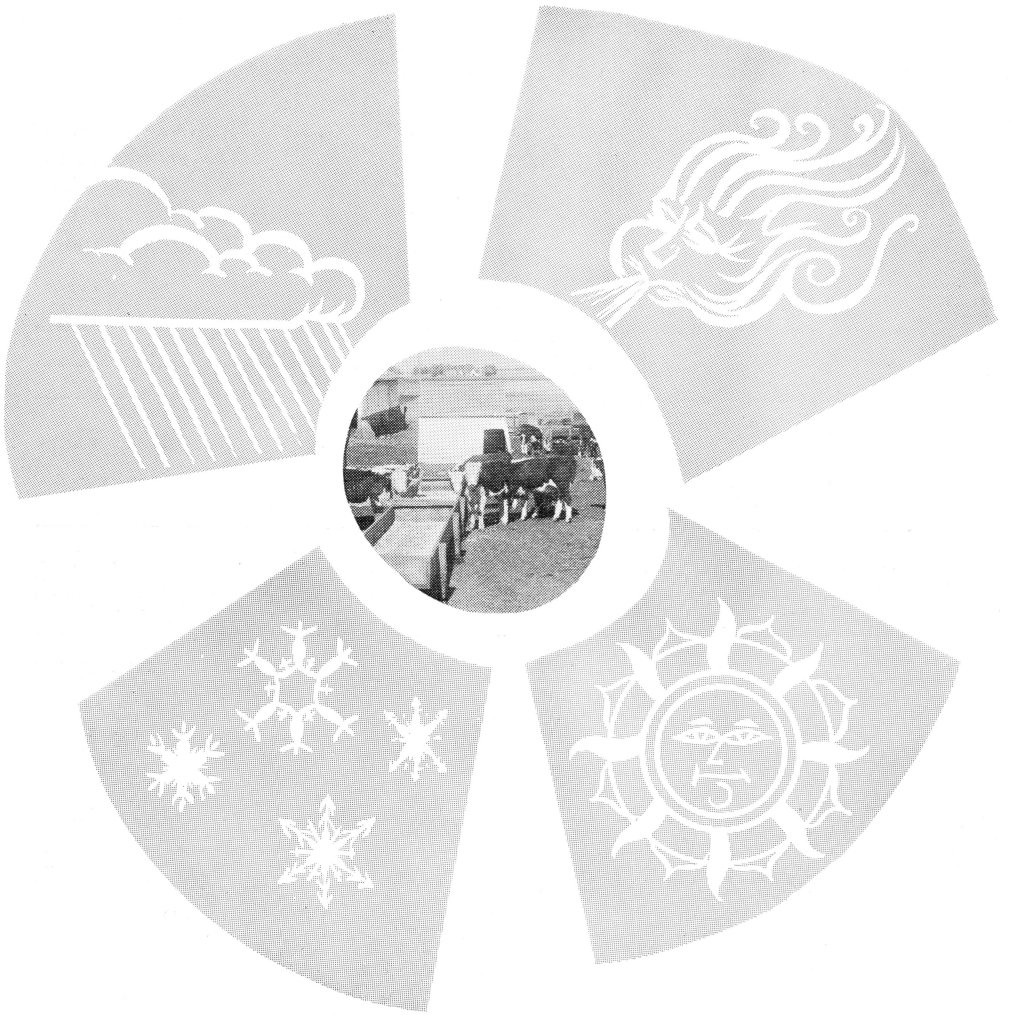

WEATHER PROTECTION FOR FEEDLOT CATTLE

by Fred W. Roth

WEATHER PROTECTION provided for feedlot cattle in the Midwest varies greatly. Research indicates buildings with open construction and good natural ventilation can boost daily gain and reduce feed costs.

The need for some form of beef cattle housing or shelter, grows out of the extremes and variability of our Iowa climate. Recorded temperatures in Iowa range from a low of 47 degrees below zero to a high of 118 degrees. These extreme temperatures occur infrequently, but in most years many parts of Iowa experience temperatures of 20 degrees below zero and nearly 100 degrees above.

Low temperatures are often accompanied by strong winds, and high temperatures sometimes prevail when there is no wind at all. To make matters worse, cold rain, sleet or snow frequently occur along with cold temperatures and wind.

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Iowa is in a region of rapid weather changes. In the winter, temperature drops of 60 to 70 degrees in 12 hours are not uncommon. And during any season, drastic weather changes can take place in a day. These unfavorable weather periods, though only a small fraction of the year, establish the need for some form of weather protection.

However, the decision to invest in housing or other forms of protection depends on how feedlot cattle respond to climatic variables. Studies have shown that air temperature, relative humidity, air motion and thermal radiation are significant elements of the climatic environment affecting animal gains and productivity. Here it is well to recognize that an animal's responses are affected by the climate immediately surrounding it, the *microclimate*, rather than by the general climatic conditions in an area.

In addition to climatic variables, other things such as terrain, design and placement of buildings; their color; presence or absence of shade; type of fences; and kind of surface under foot affect the microclimate. Animal density in a lot or pen is also a factor because cattle generate large amounts of heat into their surroundings.

Animal Responses to Climate

Air temperature is probably most important, as well as most easily measured, among climatic variables affecting gains of feedlot cattle. Experiments indicate the comfort zone of domestic breeds of beef cattle is between 30 degrees and 75 degrees F. However, various breeds and individuals within a particular breed vary widely in ability to tolerate heat and cold.

Cattle adjust to climatic extremes by decreasing their feed consumption during hot weather and increasing consumption when it is cold. This affects the amount of heat generated by the animals, since about one-third of the feed consumed is converted to heat during the digestive process. Exposure to extreme temperatures, either hot or cold, makes body temperature regulation by the animal more dif-

ficult (stress) and is likely to result in lowered productivity.

Air motion is an important environmental factor. Cattle are not classed as sweating animals like horses and man, but they do lose considerable water through their skins. Increased air velocity speeds up evaporation of moisture on the animal's skin causing more rapid cooling. The value of having adequate air flow around feedlot cattle during hot weather is unquestioned. In one California test, fanned cattle increased their daily gains by 1.03 pounds over unfanned cattle. However, during the cold season, the objective is to reduce wind velocity and prevent drafts.

High relative humidity increases adverse effects of both high and low temperatures. From human experience we know that hot, humid, calm air, and cold, damp winds both cause discomfort and stress.

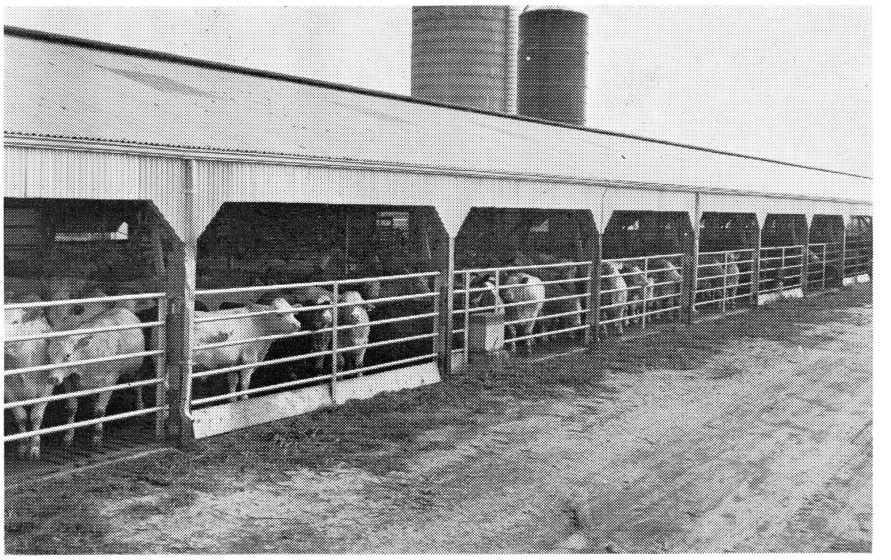
Thermal radiation, also an important variable in the environment, affects heat losses and gains of cattle—and consequently their comfort and performance. In daylight, the sun is the greatest source of radiant heat on the landscape. Solid objects, building walls and other objects in the environment also radiate energy at different rates. The cattle radiate heat to each other and to their environment. The total solar radiation in midsummer is about four times greater than in December.

By cutting off the direct rays of the sun, shade trees or artificial shades reduce the radiant heat load on animals, while leaving them exposed to the cool northern sky. Exposure to the cool sky may contribute to warm weather comfort by serving as a cool sink into which animals can radiate body heat. However, during the cold season, the situation is reversed. The object is to take advantage of solar radiation during the day and minimize heat loss by radiation from the animals' bodies at night. On a clear, cold night, the black sky rapidly soaks up a great amount of heat from the earth and all objects on the surface.

Making Conditions Favorable

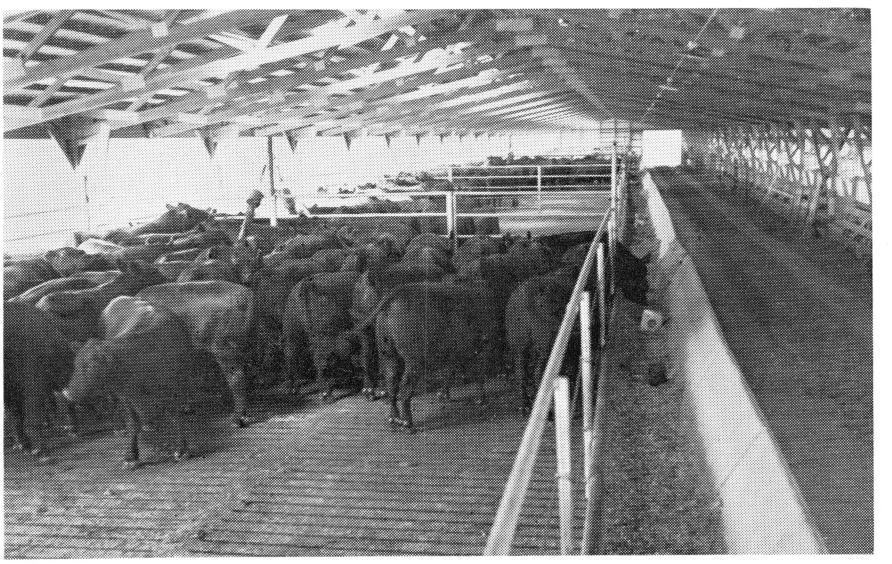
Windbreaks are the simplest means of improving the winter climate in your feedlot. With favorable terrain a good windbreak can effectively slow down wind and blowing snow, but temperature and radiation are affected little.

Constructed windbreaks are more effective over a larger area if you build them with 15 to 20 percent of the wall area open. This allows some air to blow through, spreading snowdrifts out over a larger area. A 2-inch space between 12-inch-wide boards is about right. The higher the windbreak, the more lot area it will protect. Plant a tree windbreak 75 to 100 feet back from the area to be protected so that snow will be dropped before it reaches the lot area.



THIS CONFINEMENT beef feeding system, located in the Des Moines area, features slotted floors in a building open on the south side. Doors in the north wall open for summer ventilation.

Sunshades can reduce the radiant heat load on an animal by as much as 30 to 50 percent. In California tests, hay or straw was found the most effective of some 50 possible roofing materials. Aluminum roofing sheets reflect heat well, but either aluminum or steel sheets are better reflectors when painted white on top. Wood lath snow fencing stretched across supports mounted on poles, makes an effective and inexpensive sunshade.



EIGHT-FOOT deep manure pits under the slotted floor of the confinement building are emptied twice a year. The drive-through alley is used for feeding and cattle handling.

We suggest making shades 10 to 12 feet high to permit good air movement under the canopy. Provide 25 to 30 square feet per animal. Orienting sunshades in an east-west direction results in maximum effectiveness, but a north-south orientation promotes drying and better sanitation under the canopy.

When feeding and watering areas are shaded, animals tend to congregate there, increasing the likelihood of contaminating feed and water with manure and developing messy areas. If the shade is separated from the feeding area, Arizona studies suggest locating the shade within 50 feet of the feed bunk.

In deciding for or against shades, as with other improvements, you need to weigh the costs against the value of the probable gains. Shades are likely to bring a return on investment only during 15 to 20 days in the July-August period, with perhaps a few days in June. During winter, shades in the feedlot may be a liability because they interfere with drying and thawing action of the sun.

Buildings let you control the variables in the animals' microclimate more completely than is possible with shades or windbreaks. Great differences in microclimate may exist between two spots separated by only a few hundred feet. These variations result from terrain features, and location of trees, buildings and other structures such as silos and grain storages. Take this into account when selecting and developing a site for a cattle feeding system.

The extent to which the shelter should be enclosed depends upon the immediate climatic conditions and the type of environment desired for the animals.

Cattle Housing Studied

Evidence that extremely high temperatures have more adverse effect on performance of feedlot cattle than low temperatures has tended to place more emphasis on buildings with one side open and good natural ventilation. This is the type of housing that was compared with no housing in a 5-year study at the Allee Experimental Farm near Storm Lake. Six outdoor lots, each 35 x 100 feet, were used with 18 to 22 yearling feeders in each lot. For each trial, the same number of animals was put in each lot.

Cattle in three lots had shelter available in a large barn from which the haymow floor had been removed to permit complete and free exchange of air. The area inside the barn for each of the lots is approximately 30 x 30 feet. About one-third of the south wall is open to provide entrance from the outside lots. Three lots had no shelter, only a windbreak fence 7 to 8 feet high along the north side.

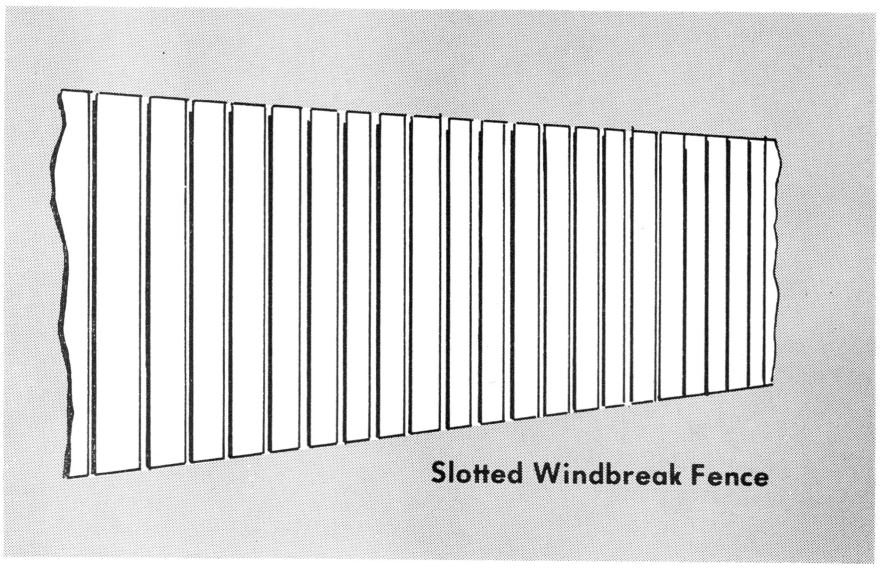
Table 1 summarizes the results of five winter trials and four summer trials. In all nine trials, cattle with overhead shelter gained faster and used less feed per pound of gain.

Combining the five winter trials, average daily gain per head was 0.40 pounds more and feed consumption per hundredweight of gain was 129 pounds less by the cattle with shelter. Total feed consumption by both groups was nearly the same (the shelter group ate 1.1 percent more), but the cattle with shelter available gained an average of 55 pounds per head (17.3 percent) more than the non-shelter groups.

The four summer trials yielded smaller differences in average daily gain and feed consumption per hundredweight of gain, but sheltered animals showed an advantage in all cases. The extra weight gained by the sheltered cattle averaged 25 pounds per head.

Increased gains by the cattle under shelter indicate the value of the shelter used in these trials. The figures from the winter and summer trials (55 pounds and 25 pounds per head, respectively) give a combined value of 80 pounds extra marketable gain per year. This represents the possible economic advantage of shelter under the management and weather conditions during the trials.

It may not be possible to obtain similar results in your feedlot where management and weather may be different. Weather data at the Storm Lake Station show average temperatures during three of the five winters were substantially below normal. However, despite the apparently colder winters these trials suggest that housing for feeder cattle can pay for itself.



A 15 to 20 percent opening in the wall is recommended.

Initial investment for only the building shell is typically about $1 per square foot of floor area. Assuming a 15-year life, it should not be difficult to amortize this investment even though the benefits of shelter might be only 50 percent of the values obtained in the 5-year trials.

Building Use Varies

Buildings for housing feeder cattle can be used in two different ways. You can locate them separately, away from the feeding area,

or you can incorporate the feeding area in the building.

In the first instance, housing tends to be minimal, and outdoor lots are usually quite large. In the second approach, outdoor lots may be eliminated and slotted floors can take the place of bedding. (See photographs.) The feeding area may be extended down the midline of the building, or along one side. Space allowances in total confinement range from about 2½ to 3 square feet per 100 pounds of animal weight.

Our present knowledge and experience suggest that buildings with one side open and the feeding areas incorporated under roof can be practical and satisfactory. Another side is equipped with doors to permit opening up to 50 percent of the wall area for adequate summer ventilation.

In addition, it is essential to provide for ventilation through the peak of the roof. This is done most economically and effectively by leaving an opening six to eight inches wide at the ridge for the full length of the building.

Another arrangement widely used in South Dakota, features a mechanized feed bunk extending through the middle of a building about 40 feet wide. Sliding doors cover up to one-half of the sidewalls, and one end of the building is usually open. The doors are left open most of the time except during cold and stormy weather.

Buildings used in either manner will have more influence on the animal's microclimate and the investment may be easier to justify when it's working for you more of the time. Elimination of bedding can reduce labor cost in manure handling.

Whatever method of housing you choose, the benefits of shelter will quickly be seen in the more contented behavior of your cattle, and ultimately in greater profits for you.

TABLE 1. Summary of gains and feed consumption; cattle housing study.

Season	Feeding Period—days	Average Daily Gain—lbs.			Feed per Cwt. of Gain—lbs.		
		Shelter	No Shelter	Diff.	Shelter	No Shelter	Diff.
Winter, 1961-62	115	2.99	2.45	0.54	974	1183	209
Summer, 1962	142	2.95	2.76	0.19	910	950	40
Winter, 1962-63	99	2.94	2.51	0.43	1025	1199	174
Summer, 1964	140	2.54	2.36	0.18	991	1057	66
Winter, 1964-65	151	2.40	2.04	0.36	1100	1260	160
Summer, 1965	140	2.92	2.71	0.21	886	926	40
Winter, 1965-66	162	2.66	2.40	0.26	903	969	66
Summer, 1966	141	2.86	2.78	0.08	867	897	30
Winter, 1966-67	152	2.81	2.39	0.42	864	1001	37

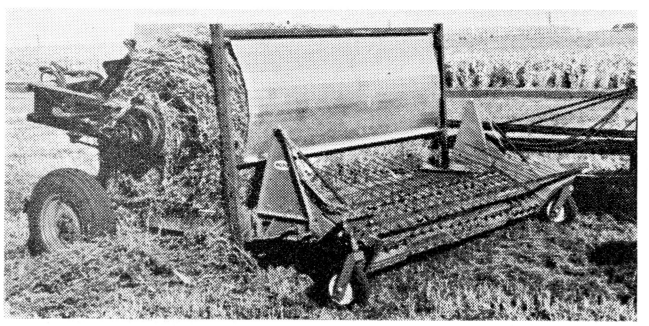
Giant Hay Baler Developed at ISU

A machine that bales, handles and feeds 1-ton hay bales is being developed at Iowa State University. Not yet perfected, the machine so far has produced bales weighing "just" 700 pounds.

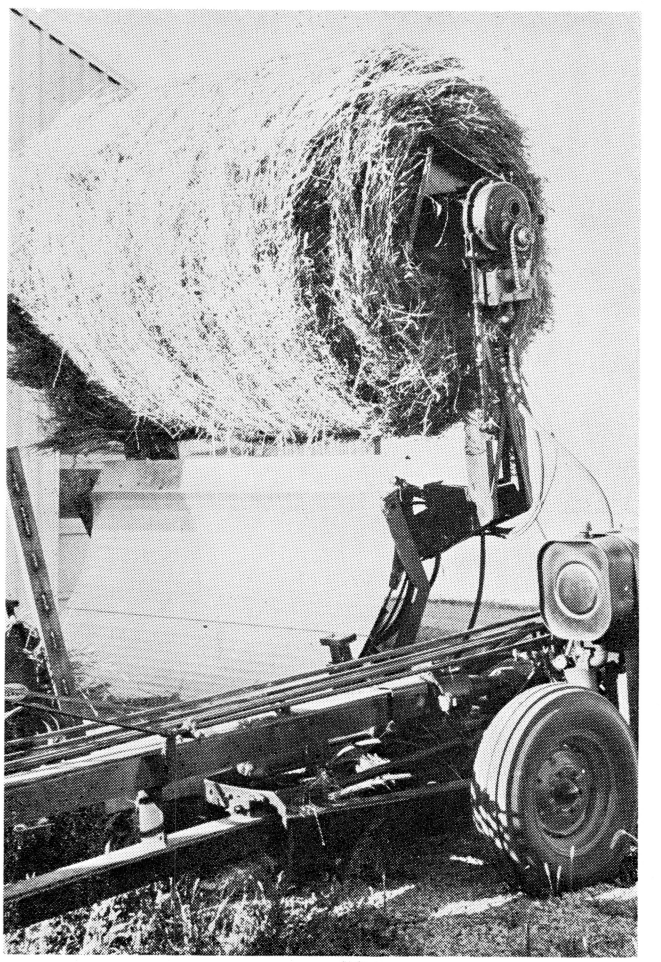
Conventional hay bales weigh about 70 pounds for convenient handling, says Wesley F. Buchele, ISU agricultural engineer. The giant bale is designed for mechanical handling.

The new machine consists of two powered spindles (one at each end of the bale). Hay from a windrow is picked up by the machine and wrapped around the spindles. Baler twine feeds into the baler along with the hay to add tensile strength. The giant bales are cylindrical, about 5 feet in diameter and 7½ feet long.

Ultimately, the tractor-mounted machine can be used to bale hay, deposit bales in the field, pickup bales, transport them to storage, place bales in storage, and to unwrap the bales and deposit the hay in feed bunks.



Giant bale being formed in chamber of baler.



Completed bale being ejected.